The Annals of Clinical and Analytical Medicine
Original Research

The prevalence and risk factors associated with snoring and obstructive sleep apnea in jazan region

Snoring and obstructive sleep apnea

Yasser Mossa Daghriri[1], Ali Nasser Jabbari[1], Amal Yahya Almalki[1], Salma Mohammed Alhassan[1], Nasser Mohammed Marran[1], Fahad Khairy Jerb[1], Hatim Saeed Alessa[1], Yasmeen Esa Ghillan[1], Alhussen Fahad Khawaji[1], Mohammad Ali Daghriri[2]
[1]Faculty of Medicine, Jazan University, Jazan, [2]Neurosurgery Service Resident, KFCH, Jazan, Saudi Arabia

Abstract

Aim: In addition to sleep study, the self-administered questionnaires have been used to identify high- risk groups among the general population as they are more feasible than sleep studies. In the literature, the Berlin questionnaire was the most commonly used followed by Wisconsin sleep questionnaire, however, STOP and STOP-BANG questionnaires were recommended due to ease of use and higher methodological quality. This study aimed to identify high-risk group of OSA in the general population of Saudi Arabia and other important risk factors. Material and Method: This was a cross-sectional study conducted through the self-administered questionnaires distributed electronically among the general population in the Jazan region where 745 adult participants those living outside the Jazan region, or those with missing data were included. Data were collected anonymously through the STOP-BANG questionnaire and then coded. The data were analyzed using frequency, percentages as descriptive statistics, while Chi-Square was used to identify significant differences. The logistic regression was conducted to identify significant predictors for previously diagnosed OSA and any p-value less than 0.05 indicated significant differences. Results: Out of 745 valid questionnaires were included in the study, 51.4% were females and 48.6% were males. The body mass index indicated that about 52% of the respondents had elevated BMI and 22% were smokers. Based on the STOP-BANG questionnaire, 16.5% of the respondents were at a high risk of OSA. Among other reported risk factors, chronic sinusitis was the most common followed by tonsillitis with the prevalence of 23.4% and 16.9%, respectively. Significant associations between reported OSA and snoring, daytime tiredness, observed stop breathing during sleep, hypertension, BMI> 35 kg m−2, and age over than 50 years. The results of binary logistic regression demonstrated that the presence of hypertension and respiratory arrest observed by others during sleep are significant predictors for reported OSA. Discussion: The identification of a high-risk group of sleeping apnea using the STOB-BANG questionnaire was found valid and reliable. Arabic version of the STOB-BANG had a good internal consistency with 0.7 Cronbach's alpha, 98% sensitivity and 86% positive predictive value. We used 7-item questionnaire, after exclusion of neck circumferences question, since the vast majority of the respondents left this question blank. . Similarly, Alharthi et al. found only 12% response rate for the question of neck diameter in Taif city. Conclusions: It was concluded that a considerable percentage of the general population in Jazan region had a high risk of obstructive sleeping apnea based on the STOB-BANG questionnaire. Hypertension and respiratory arrest observed by others during sleep were significant predictors for diagnosed OSA.

Keywords

Sleep Apnea; High Risk; Obesity; Snoring; Risk Factors

DOI: 10.4328/ACAM.6104 Received: 01.12.2018 Accepted: 05.01.2019 Published Online: 10.01.2019 Printed: 01.11.2019 Ann Clin Anal Med 2019;10(6): 682-7
Corresponding Author: Yasser Mossa Daghriri, Faculty of Medicine, Jazan University, Jazan, Saudi Arabia.
GSM: 00966557212698 E-Mail: dr.resexp@gmail.com
ORCID ID: https://orcid.org/0000-0002-5087-6452

Introduction

Obstructive sleep apnea (OSA) is a syndrome represented by recurrent episodes of obstruction in respiratory airways during sleep [1]. Repeated airway obstruction can lead to sympathetic stimulation, poor quality sleep and may be associated with daytime tiredness and morning headache [2]. It is an emerging health problem, particularly in developed countries, that has been linked to cardiovascular diseases and psychosomatic conditions such as diabetes and depression [3,4].

Globally, the prevalence of OSA in the general population is varied from 9% to 38% according to the population's characteristics and the methodological technique used to diagnose OSA [5]. Several studies have reported an increased prevalence of OSA in the last decades either in general population or in a population with a specific disease entity such as hypertension [2,4,6]. This can be attributed to the increased incidence of obesity which is the major risk factor of OSA [7]. Other risk factors include male gender, old age, familial history, smoking, or the presence of upper airways condition such as chronic tonsillitis, chronic sinusitis, and nasal adenoma [8].

Despite the development of simple diagnostic techniques with relatively accurate results, the gold standard method for diagnosis of OSA is full attended or home-based sleep-surveillance or polysomnography [9]. The self-administered questionnaires have been used to identify high-risk groups, for which polysomnography is indicated [10]. In the literature, the Berlin questionnaire was the most commonly used followed by Wisconsin sleep questionnaire, however, STOP and STOP-Bang questionnaires were recommended due to ease of use and higher methodological quality [10].

In Saudi Arabia, a study found that a third of middle-aged Saudi males at risk of OSA based on risk categorization of Berlin questionnaire. Snoring was reported in 52.3% of Saudi males and an episode/ per week of OSA was found in 11.3% [11]. Different clinical and polysomnographic features between males and females were demonstrated by sleep study conducted by Alotair and Bahammam [12]. No study used the STOP-BANG questionnaire to assess groups with high risk of OSA in Saudi general population, despite high prevalence of important risk factors such as obesity and hypertension. This study aimed to estimate the group with a high risk of OSA in the general population of Saudi Arabia and other important risk factors.

Material and Method

This was a cross-sectional study conducted through questionnaires distributed in Jazan region during the period from September 2018 to October 2018. Out of 1000 electronically distributed questionnaires viaemails, 923 were received to the assigned email in form of Excel sheets. Finally, 745 participants were included in this study after exclusion of those under 18 years of age, those living outside Jazan region, or those with missing data (36 participants).

The human subjects were included in this study after obtaining of written informed consents. They were informed about their rights to participate or withdraw at any time. They were informed about the confidentiality of the information provided in this study.

The *post hoc* power calculation showed a very high statistical power (1- β = 0.95) for a sample size of 745 at an alpha error of 0.05, a degree of freedom equals to 3, and 0.15 effect size. The calculation was made using G*Power software, version 3. The STOP-BANG questionnaire was validated in the literature and has been found to have a higher sensitivity than other questionnaires used to assess the high-risk group of OSA [13]. It includes questions about snoring, daytime tiredness, apnea observed by others, blood pressure, age, neck circumference, male gender. This questionnaire was used in this study, however, only 4 participants responded to the question of neck circumference. Thus, the question of neck circumference was excluded from further analysis and the results were presented only for STOP-BAG variables. Additionally, the questionnaire contains questions about other risk factors including smoking, familial history of OSA, previous diagnosis of nasal adenoma, tonsillitis, nasal septal deviation, chronic sinusitis, or sleeping apnea. The data were anonymously collected into Excel sheets and then imported to Statistical Package of Social sciences SPSS, version 21, for analysis. The data were summarized in frequencies and percentages for a qualitative variable. The Chi-Square was used to detect significant differences between the risk factors of OSA and the previously diagnosed OSA, as those confirmed with a physician. The logistic regression was conducted to identify significant predictors for previously diagnosed OSA and any p-value less than 0.05 indicated significant differences. The questionnaire was self-administered with covering letter explaining the aims of the study, the rights of the participants to respond or refuse, and the confidentiality of data provided. The respondent should agree to participate by checking on "I agree" before answering the questions. The study was approved by the ethical committee in Jazan University (Approval No. 52/18)

Results

Out of 1000 distributed questionnaires (500 males and 500 females), 745 valid questionnaires were included in the study. Females had a higher response rate than males since they completed 383 (51.4%) of total questionnaires, while male respondents completed 362 (48.6%) of these questionnaires. The majority of the respondents (66.2%) were young and aged 18-30 years old, while only 2.2% were older than 50 years old. The body mass index indicated that about 52% of the respondents had elevated BMI and 22% were smokers (Table 1).

The distribution of risk factors of OSA showed that feeling tired, fatigued, or sleepy during daytime is the most common risk factor which affected 66.3% followed by snoring which reported by 15.8% of the respondents. Based on the STOP-BANG questionnaire, 16.5% of the respondents were at a high risk of OSA. Among other reported risk factors, chronic sinusitis was the most common followed by tonsillitis with the prevalence of 23.4% and 16.9%, respectively (Table 2).

The relationship between STOP-BANG risk factors and reported OSA showed significant associations with such risk factors as snoring, daytime tiredness, observed respiratory arrest during sleep, hypertension, BMI> 35 kg m−2, and age over 50 years. Only male gender had no significant association with reported OSA (Table 3). Smoking and positive family history of OSA had no significant associations with reported OSA. In addi-

Table 1. Background characteristics of the respondents, (n = 745):

Variables	Frequency	Percent (%)
Gender:		
Male	362	48.6
Female	383	51.4
Age:		
18-30	493	66.2
31-40	180	24.2
41-50	56	7.5
51-60	14	1.9
> 60	2	0.3
Body mass index (BMI) (n=745):		
Underweight	113	15.2
Normal weight	246	33.0
Overweight	214	28.7
Class 1 obesity	99	13.3
Class II obesity	37	5.0
Class III obesity	36	4.8
Smoking (n=745):		
No	581	78.0
Yes	164	22.0

Table 2. Distribution of Risk factors associated with Obstructive sleep apnea (OSA)

Variables	Frequency	Percent (% of total respondents)
Risk factors of OSA according to Stop-Bang questionnaire		
Gender: Male	362	48.6
Snoring: I snore loudly (loud enough to be heard through closed doors)?	118	15.8
Tired: I often feel tired, fatigued, or sleepy during daytime?	494	66.3
Observed: Somebody observed that I stop breathing during your sleep?	73	9.8
Blood pressure: I have or I am being treated for high blood pressure?	36	4.8
BMI: BMI more than 35 kg m^{-2}?	71	9.5
Age: Age over 50 year old?	16	2.1
Risk of OSA based on Stop-Bang questionnaire		
High risk of OSA	123	16.5
Low risk of OSA	622	83.5
Other Risk factors of OSA		
Have you been diagnosed with nasal adenoma?		
Yes	77	10.3
No	668	89.7
Have you been diagnosed with tonsillitis?		
Yes	126	16.9
No	619	83.1
Have you been diagnosed with septal deviation in the nose?		
Yes	69	9.3
No	676	90.7
Have you been diagnosed with chronic sinusitis?		
Yes	174	23.4
No	571	76.6
Have you been diagnosed with sleeping apnea?		
Yes	27	3.6
No	718	96.4

Table 3. Associations between risk factors (based on Stop-Bang questionnaire) and diagnosis of OSA (n = 745)

Variables Diseased		Reported diagnosis of sleep apnea		Chi-square	P-value
		Not diseased			
Gender	Female	14	369	0.002	0.963
		3.7%	96.3%		
	Male	13	349		
		3.6%	96.4%		
Snoring: I snore loudly (loud enough to be heard through closed doors)?	No	4	247	6.432	0.011
		1.6%	98.4%		
	Yes	23	471		
		4.7%	95.3%		
Tired: I often feel tired, fatigued, or sleepy during daytime?	No	4	247	4.468	0.035
		1.6%	98.4%		
	Yes	23	471		
		4.7%	95.3%		
Observed: Somebody observed that you stop breathing during your sleep?	No	16	656	30.347	0.001
		2.4%	97.6%		
	Yes	11	62		
		15.1%	84.9%		
Blood pressure: I have or I am being treated for high blood pressure?	No	21	688	18.423	0.001
		3.0%	97.0%		
	Yes	6	30		
		16.7%	83.3%		
BMI: BMI more than 35 kg m^{-2}?	≤35 Kg/m-2	21	653	5.234	0.022
		3.1%	96.9%		
	>35 Kg/m^{-2}	6	65		
		8.5%	91.5%		
Age: Age over 50-year-old?	≤ 50 years old	26	703	30.347	0.001
		3.6%	96.4%		
	>50 years old	1	15		
		6.2%	93.8%		

tion, the presence of nasal adenoma and chronic sinusitis were not significantly associated with the reported OSA (p=0.39 and p=0.212 respectively). Conversely, chronic sinusitis and nasal septum deviation were significantly associated with reported OSA (Table 4).

The results of binary logistic regression demonstrated that the presence of hypertension and respiratory arrest observed by others during the sleep are significant predictors for reported OSA. The respondents who were observed by others and experienced a respiratory arrest during sleep had 5.6 greater risk to report previously diagnosed OSA. Furthermore, hypertensive patients had about 4 times greater risk to report previously diagnosed OSA. Other STOP-BANG factors such as snoring, daytime tiredness, BMI> 35 kg m−2, and age over50 years had no significant associations with reported OSA (Table 5).

Discussion

The identification of the high-risk group of sleeping apnea using STOB-BANG questionnaire was found valid and reliable. Arabic version of STOB-BANG had a good internal consistency with 0.7 Cronbach's alpha, 98% sensitivity and 86% positive predictive value [14]. We used 7-item questionnaire, after exclu-

Table 4. Cross tabulation between important risk factors and diagnosis of OSA (n = 745)

Risk factors Diseased		Diagnosed Sleep Apnea		Chi-square	P-value
		Not diseased			
Smoking	Yes	5	159	0.199	0.815
		3.0%	97.0%		
	No	22	559		
		3.8%	96.2%		
Have you been diagnosed with nasal adenoma?	Yes	7.8%	92.2%	4.271	0.39
		21	647		
	No	3.1%	96.9%		
		7.8%	92.2%		
Have you been diagnosed with chronic tonsillitis?	Yes	12	114	15.112	0.001
		9.5%	90.5%		
	No	15	604		
		2.4%	97.6%		
Have you been diagnosed with septal deviation in the nose?	Yes	9	60	19.316	0.001
		13.0%	87.0%		
	No	18	658		
		2.7%	97.3%		
Have you been diagnosed with chronic sinusitis?	Yes	9	165	1.558	0.212
		5.2%	94.8%		
	No	18	553		
		3.2%	96.8%		
Did any 1st degree relative of you had OSA?	Yes	7	105	2.602	0.107
		6.2%	93.8%		
	No	20	613		
		3.2%	96.8%		

Table 5. Findings of binary logistic regression showed predictors of obstructive sleeping apnea

Variables	P- value	Odd Ratio (O.R)	95% CI for OR	
			Lower	Upper
Gender: Male	0.589	0.792	0.340	1.844
Snoring: I snore loudly (loud enough to be heard through closed doors)?	0.656	1.251	0.467	3.349
Tired: I often feel tired, fatigued, or sleepy during daytime?	0.083	2.647	0.881	7.960
Observed: Somebody observed that I stop breathing during my sleep?	0.000*	5.602	2.294	13.680
Blood pressure: I have or I am being treated for high blood pressure?	0.015*	3.977	1.314	12.034
Age: Age over 50 year old?	0.765	0.704	0.071	7.012
BMI: BMI more than 35 kg/m^{-2}?	0.083	2.440	0.890	6.688

sion of neck circumferences question, since the vast majority of the respondents left this question blank. Similarly, Alharthi *et al.* found only 12% response rate for the question of neck diameter in Taif city.

The present study found 16.5% of the respondents at high risk of OSA based on STOB-BANG questionnaire, which was less than that found by Alharthi *et al.* who used Berlin questionnaire and found a quarter of the studied sample at a high risk of OSA [15]. As the STOB-BANG questionnaire used by our study was found more sensitive than Berlin questionnaire use by Alharthi *et al.* and this difference can be attributed partly to less false positives in our findings. In addition, our study area in Jazan are partially mountainous, while Taif city is elevated 1879 m above sea level. Sleeping at high altitude is characterized by poor sleep quality due to hypoxia [16]. Another study carried out by Foroughi *et al.* who used STOB-BANG questionnaire and found a higher prevalence of 38% in Tehran city [17]. This can be explained by the high altitude of Tehran city which located in 1189 above sea level and different population characteristics. The population characteristics are an important modifier in the assessment of OSA high-risk group. A study conducted among Chinese population recommended using BMI cutoff point of (28 kg/m^2) and a STOB-BANG score ≥4, rather than (35 kg/m2) BMI cutoff point and a score ≥3 [18]. In the present study, the body mass index indicated that about 52% of the respondents had elevated BM. Similar findings were reported by Alharthi *et al.* with the percentage of elevated BMI in Taif city equals to 52.7% [15]. The overall prevalence of overweight and obesity in Saudi Arabia was found to range from 35.5% to 53% [19,20]. In our study, 4.8% said they have or they are being treated for high blood pressure, a higher prevalence of 8.7% was reported by Alharthi *et al.* [15].

We found the relationship between STOP-BANG risk factors and reported OSA showed significant associations with risk factors such as snoring, daytime tiredness, observed respiratory arrest during sleep, hypertension, BMI> 35 kg m−2, and aged over 50 years. Only male gender had no significant association with reported OSA. In a study conducted among patients who underwent pulmonary rehabilitation program no association between male gender and OSA was found [21]. In the current study, smoking had no significant associations with reported OSA, which was consistent with *Alharthi et al.* [15]. In a study conducted among patients who underwent pulmonary rehabilitation program no significantl association between predictors such as male sex, old age group, and large neck circumference not and OSA was found [21]. Several studies conducted in Saudi Arabia among patients with chronic diseases such as coronary heart diseases [22] or chronic renal failure [23] and their findings differed markedly from findings of the present study that surveyed general population. Wali *et al.* found 82% prevalence of high-risk OSA among patients with coronary heart diseases based on STOP-BANG questionnaire [22]. It is markedly higher than the prevalence in the present study (16.5%) and it can be attributed to the shared risk factors between OSA and coronary heart diseases such as old age, high BMI, hypertension and male gender. Another study conducted by Wali *et al.* found a 44.2% prevalence of high-risk OSA among patients with chronic renal failure based on the Berlin questionnaire [23]. Patients with chronic heart failure are more likely to be hypertensive [6], which is a shared risk factor with OSA and the Berlin questionnaire is more likely to detect false positive cases of OSA than the STOP-BANG questionnaire.

About 10% of our respondents reported that somebody noticed that they stop breathing while sleeping, a lower percentage reported by Alharthi *et al.* with only 4.8% who said that anyone observed that they stop breathing while sleeping [15]. In the present study, 66.3% of the respondents felt tired, fatigued, or sleepy during the daytime. Similarly, Alharthi *et al.* found 64.7% complaining of daytime tiredness and fatigue in Taif city [15]. This reflected similar characteristics of the populations in Jazan and Taif regions. However, Foroughi *et al.* found loud snoring as the most common symptom when using STOB-BANG questionnaire [17]. In the present study, loud snoring reported by 15.8% of the respondents, agreed with Alharthi *et al.* who reported that 14.2% of the mountainous inhabitants snored louder than talking [11].

Binary logistic results showed that the presence of hypertension and respiratory arrest observed by others during sleep were significant predictors for reported OSA. Soler *et al.* conducted a logistic regression analysis and found traditional predictors of OSA, included in STOB-BANG questionnaire, not significant except for the presence of cardiovascular diseases [21]. The logistic regression is usually controlling the confounding effects of the variables introduced in the model, thus many significant associations which previously detected by Chi-Square became non-significant associations in the regression model. In the model, the respondents who were observed by others to have a respiratory arrest during sleep had 5.6 greater risk to report previously diagnosed OSA. Moreover, hypertensive patients had about 4 times greater risk to report previously diagnosed OSA. These results explained the importance of observed and hypertension items of STOP-BANG questionnaire in the detection of people with high risk of OSA.

Conclusions

It was concluded that a considerable percentage of the general population in Jazan region had a high risk of obstructive sleeping apnea based on STOB-BANG questionnaire; however, it was less than the percentage identified by other questionnaires. In addition, this percentage was less than that detected in other chronic disease-specific groups or other regions in Saudi Arabia. Hypertension and respiratory arrest observed by others during sleep were significant predictors for documented OSA.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

Funding: None

Conflict of interest

None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.

References

1. Park JG, Ramar K, Olson EJ. Updates on definition, consequences, and management of obstructive sleep apnea. In, Mayo Clinic Proceedings: Elsevier. 2011: 549-55.
2. Arnardottir ES, Bjornsdottir E, Olafsdottir KA, Benediktsdottir B, Gislason T. Obstructive sleep apnoea in the general population: highly prevalent but minimal symptoms. European Respiratory Journal. 2016; 47(1): 194-202.
3. Eastwood PR, Malhotra A, Palmer LJ, Kezirian EJ, Horner RL, Ip MS, et al. Obstructive sleep apnoea: from pathogenesis to treatment: current controversies and future directions. Respirology. 2010; 15(4): 587-95.
4. Somers VK, White DP, Amin R, Abraham WT, Costa F, Culebras A, et al. Sleep apnea and cardiovascular disease: An american heart association/american college of cardiology foundation scientific statement from the american heart association council for high blood pressure research professional education committee, council on clinical cardiology, stroke council, and council on cardiovascular nursing in collaboration with the national heart, lung, and blood institute national center on sleep disorders research (national institutes of health). Journal of the American College of Cardiology. 2008; 52(8): 686-717.
5. Senaratna CV, Perret JL, Lodge CJ, Lowe AJ, Campbell BE, Matheson MC, et al. Prevalence of obstructive sleep apnea in the general population: a systematic review. Sleep Medicine Reviews. 2017; 34: 70-81.
6. Nieto FJ, Young TB, Lind BK, Shahar E, Samet JM, Redline S, et al. Association of sleep-disordered breathing, sleep apnea, and hypertension in a large community-based study. Jama. 2000; 283(14): 1829-36.
7. Gami AS, Caples SM, Somers VK. Obesity and obstructive sleep apnea. Endocrinology and Metabolism Clinics. 2003; 32(4): 869-94.
8. Punjabi NM. The epidemiology of adult obstructive sleep apnea. Proceedings of the American Thoracic Society. 2008; 5(2): 136-43.
9. Zou D, Grote L, Peker Y, Lindblad U, Hedner J. Validation a portable monitoring device for sleep apnea diagnosis in a population based cohort using synchronized home polysomnography. Sleep. 2006; 29(3): 367-74.
10. Abrishami A, Khajehdehi A, Chung F. A systematic review of screening questionnaires for obstructive sleep apnea. Canadian Journal of Anesthesia/Journal canadien d'anesthésie. 2010; 57(5): 423-38.
11. BaHammam AS, Alrajeh MS, Al-Jahdali HH, BinSaeed AA. Prevalence of symptoms and risk of sleep apnea in middle-aged Saudi males in primary care. Saudi Medical Journal. 2008; 29(3): 423-6.
12. Alotair H, BaHammam A. Gender differences in Saudi patients with obstructive sleep apnea. Sleep and Breathing. 2008; 12(4): 323-9.
13. Chung F, Subramanyam R, Liao P, Sasaki E, Shapiro C, Sun Y. High STOP-Bang score indicates a high probability of obstructive sleep apnoea. British journal of anaesthesia. 2012; 108(5): 768-75.
14. BaHammam AS, Al-Aqeel AM, Alhedyani AA, Al-Obaid GI, Al-Owais MM, Olaish AH. The validity and reliability of an Arabic version of the STOP-Bang questionnaire for identifying obstructive sleep apnea. The Open Respiratory Medicine Journal. 2015; 9: 22-25.
15. Alharthi FR, Masoodi I, Alomairi N, Hassan A, Alfaifi A. The Predictors of Obstructive Sleep Apnea at A High Altitude: Results of a Population-based Study in the Western region of Saudi Arabia. Egyptian Journal of Hospital Medicine. 2018; 73(1): 5818-27
16. Weil JV. Sleep at high altitude. High altitude medicine & biology. 2004; 5(2): 180-9.
17. Foroughi M, Malekmohammad M, Sharafkhaneh A, Emami H, Adimi P, Khoundabi B. Prevalence of Obstructive Sleep Apnea in a High-Risk Population Using the Stop-Bang Questionnaire in Tehran, Iran. Tanaffos. 2017; 16(3): 217-21.
18. Xia M, Liu S, Ji N, Xu J, Zhou Z, Tong J, et al. BMI 35 kg/m 2 does not fit everyone: a modified STOP-Bang questionnaire for sleep apnea screening in the Chinese population. Sleep and Breathing. 2018, 22(4): 1075-82.
19. Al-Nozha MM, Al-Mazrou YY, Al-Maatouq MA, Arafah MR, Khalil MZ, Khan NB, et al. Obesity in Saudi Arabia. Saudi Medical Journal. 2005; 26(5): 824-9.
20. Al-Nuaim AA, Bamgboye EA, Al-Rubeaan KA, Al-Mazrou Y. Overweight and obesity in Saudi Arabian adult population, role of sociodemographic variables. Journal of community health. 1997; 22(3): 211-23.
21. Soler X, Liao S-Y, Marin JM, Lorenzi-Filho G, Jen R, DeYoung P, et al. Age, gender, neck circumference, and Epworth sleepiness scale do not predict obstructive sleep apnea (OSA) in moderate to severe chronic obstructive pulmonary disease (COPD): The challenge to predict OSA in advanced COPD. PloS one. 2017; 12(5): DOI: 10.1371/journal.pone.0177289.
22. Wali SO, Alsharif MA, Albanji MH, Baabbad MS, Almotary HM, Alama N, et al. Prevalence of obstructive sleep apnea among patients with coronary artery disease in Saudi Arabia. Journal of the Saudi Heart Association. 2015; 27(4): 227-33.
23. Wali SO, Alkhouli A, Howladar M, Ahmad I, Alshohaib S, Al-Ghamdi S, et al. Risk of obstructive sleep apnea among Saudis with chronic renal failure on hemodialysis. Annals of thoracic medicine. 2015; 10(4): 263-6.

How to cite this article:
Daghriri YM, Jabbari AN, Almalki AY, Alhassan SM, Marran NM. The prevalence and risk factors associated with snoring and obstructive sleep apnea in jazan region. Ann Clin Anal Med 2019;10(6): 682-7.